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Application No. 10/678,408

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

- (Currently Amended) A lubricating An antiwear composition for use as an additive for lubricants, comprising:
 - (a) a major portion of an oil of lubricating viscosity; and
 - (b) about 0.1 to 10 percent by mass of an antiwear additive comprising:
 - (1) an organo borate ester composition, wherein the amount of organo borate ester in the lubricating composition is less than about 1.0 percent by mass; and
 - (2) one or more components selected from the group consisting of:
 - (i) 1,3,4-thiadiazole compounds of the formula (I):

$$R \longrightarrow S \longrightarrow R^1 \qquad (I)$$

wherein R and R¹ are independently selected from hydrogen and C₈₋₁₂ thioalkyl or hydrogen, C₁.

22-alkyl groups, terpene residue and maleic acid residue of the formula:

and R^2 and R^3 represent C_{1-22} -alkyl and C_{5-7} -cycloalkyl groups, R or R^3 and either R^2 or Page 2 of 15

R³ may be hydrogen, wherein the ratio of organo borate ester to the 1, 3, 4 – thiadiazole compound is 1:3 to 15:1

(ii) bisdithiocarbamate compounds of the formula (II):

$$\mathbb{R}^{5}$$
 \mathbb{R}^{6}
 \mathbb{R}^{7}
 \mathbb{R}^{7}
 \mathbb{R}^{7}
 \mathbb{R}^{7}

wherein R⁴, R⁵, R⁶, and R⁷ are aliphatic hydrocarbyl groups having 1 to 13 carbon atoms and R⁸ is an alkylene group having 1 to 8 carbon atoms, wherein the ratio of organo borate ester: bisdithiocarbamate is 1:6 to 15:1;

(iii) dithiocarbamates of the formula (III):

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wherein R⁹ and R¹⁰ represent alkyl groups having 1 to 8 carbon atoms, M represents metals of the periodic groups IIA, IIIA, VA, VIA, IB, IIB, VIB, VIII and a salt moiety formed from an amine of the formula:

 R^{11} , R^{12} and R^{13} being independently selected from hydrogen and aliphatic groups having 1 to 18 carbon atoms and n is the valence of M;

or the formula (IV):

where R⁴, R⁵, R⁶, and R⁷ are aliphatic hydrocarbyl groups having 1 to 13 carbon atoms and R⁸ is an alkylene group having 1 to 8 carbon atoms; wherein the ratio of organo borate ester: dithiocarbamate is 1:15 to 15:1

(iv) phosphorodithioates of the formula (V):

$$\begin{bmatrix} X^1 & & & \\ R^{14} & O & & \\ & & &$$

wherein X¹ and X² are independently selected from S and O, R¹⁴ and R¹⁵ represent hydrogen and alkyl groups having 1 to 22 carbon atoms, M represents metals of the periodic groups IIA, IIIA, VA, VIA, IB, IIB, VIB, VIII and a salt moiety formed from an amine of the formula:

R¹⁶, R¹⁷ and R¹⁸ being independently selected from hydrogen and aliphatic groups having 1 to 18 carbon atoms and n is the valence of M, wherein the ratio of organo borate ester: phosphorodithioate is 1:15 to 15:1; and

(v) phosphorodithioate esters of the formula (VI):

$$R^{19} - O = R^{21}$$
 (VI)

wherein R¹⁹, R²⁰, R²¹, and R²² may be the same or different and are selected from alkyl groups having 1 to 8 carbon atoms; wherein the ratio of organo borte ester: phosphorodithioate ester is 1:15 to 15:1; and

- (vi) a non-sulfur molybdenum additive prepared by reacting (a) about 1.0 mole of fatty oil having 12 or more carbon atoms, (b) about 1.0 to 2.5 moles diethanolamine and (c) a molybdenum source, wherein the ratio of organo borate ester: non sulfur molybdenum additive is 1:15 to 15:1.
- 2. (Original) The composition of claim 1, wherein the borate ester composition is the reaction product formed by reacting about 1 mole fatty oil, about 1.0 to 2.5 moles diethanolamine followed by subsequent reaction with boric acid to yield about 0.1 to 3 percent boron by mass.

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- 3. (Original) The composition of claim 2, wherein the borate ester composition comprises about 0.8-1.2 % boron.
- 4. (Cancelled)
- 5. (Cancelled)
- 6. (Original) The composition of claim 3, wherein component (2) comprises (iii) the dithiocarbamates.
- 7. (Previously Presented) The composition of claim 1, wherein the ratio of component (1) to component (2) is about 2:1 to 1:1.
- 8. (Original) The composition of claim 3, wherein component (2) comprises (ii) the bisdithiocarbamates.
- 9. (Original) The composition of claim 8, wherein the ratio is about 1:4 to 9:1.
- 10. (Original) The composition of claim 3, wherein component (2) comprises (iv) the phosphorodithioates.
- 11. (Original) The composition of claim 3, wherein component (2) comprises (v) phosphorodithicate esters.
- 12. (Original) The composition of claim 3, wherein component (2) comprises the non-sulfur molybdenum additive of (vi).

- 13. (Original) The composition of claim 12, wherein the ratio is about 1:1 to 3:1.
- 14. (Original) The composition of claim 3, wherein component (2) comprises (i) the thiadiazoles.
- 15. (Original) The composition of claim 14, wherein the ratio is about 3:7 to 9:1.
- 16. (Cancelled)
- 17. (Currently Amended) The lubricating composition of claim <u>1</u> 16, wherein component (2) of the additive composition comprises a phosphorodithicate of formula V

$$\begin{bmatrix} X^1 & & & \\ R^{14} & & & \\$$

wherein X¹ and X² are independently selected from S and O, R¹⁴ and R¹⁵ represent hydrogen and alkyl groups having 1 to 22 carbon atoms, M represents metals of the periodic groups IIA, IIIA, VA, VIA, IB, IIB, VIB, VIII and a salt moiety formed from an amine of the formula:

R¹⁶, R¹⁷ and R¹⁸ being independently selected from hydrogen and aliphatic groups having 1 to 18 carbon atoms and n is the valence of M,

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wherein the phosphorus content is less than 0.05% by mass, based on the total mass of the lubricating composition.

18. (Previously Presented) A method for providing increased antiwear protection to an engine, said method comprising the step of using a lubricating composition comprising
(a) a major portion of an oil of lubricating viscosity; and

(b) about 0.1 to 10 percent by mass of an antiwear additive comprising:

- (1) an organo borate ester composition, wherein the amount of organo borate ester in the lubricating composition is less than about 1.0 percent by mass; and
 - (2) one or more components selected from the group consisting of:
 - (i) 1,3,4-thiadiazole compounds of the formula (I):

wherein R and R¹ are independently selected from hydrogen and C₈₋₁₂ thioalkyl or hydrogen, C₁₋₂₂-alkyl groups, terpene residue and maleic acid residue of the formula:

and R^2 and R^3 represent C_{1-22} -alkyl and C_{5-7} -cycloalkyl groups, R or R^2 and either R^2 or R^3 may be hydrogen, wherein the ratio of organo borate ester to the 1, 3, 4 – thiadiazole compound is 1:3 to 15:1

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(ii) bisdithiocarbamate compounds of the formula (II):

wherein R⁴, R⁵, R⁶, and R⁷ are aliphatic hydrocarbyl groups having 1 to 13 carbon atoms and R⁸ is an alkylene group having 1 to 8 carbon atoms, wherein the ratio of organo borate ester: bisdithiocarbamate is 1:6 to 15:1;

(iii) dithiocarbamates of the formula (III):

$$\begin{pmatrix}
R^9 \\
R^{10}
\end{pmatrix}$$

$$\begin{pmatrix}
R^9 \\
N
\end{pmatrix}$$

$$\begin{pmatrix}
M & \text{th} \\
N
\end{pmatrix}$$

$$\begin{pmatrix}
M & \text{th} \\
N
\end{pmatrix}$$

wherein R⁹ and R¹⁰ represent alkyl groups having 1 to 8 carbon atoms, M represents metals of the periodic groups IIA, IIIA, VA, VIA, IB, IIB, VIB, VIII and a salt moiety formed from an amine of the formula:

R¹¹, R¹² and R¹³ being independently selected from hydrogen and aliphatic groups having Page 9 of 15

1 to 18 carbon atoms and n is the valence of M; or the formula (IV):

where R⁴, R⁵, R⁶, and R⁷ are aliphatic hydrocarbyl groups having 1 to 13 carbon atoms and R⁸ is an alkylene group having 1 to 8 carbon atoms; wherein the ratio of organo borate ester: dithiocarbamate is 1:15 to 15:1

(iv) phosphorodithioates of the formula (V):

wherein X¹ and X² are independently selected from S and O, R¹⁴ and R¹⁵ represent hydrogen and alkyl groups having 1 to 22 carbon atoms, M represents metals of the periodic groups IIA, IIIA, VA, VIA, IB, IIB, VIB, VIII and a salt moiety formed from an amine of the formula:

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R¹⁶, R¹⁷ and R¹⁸ being independently selected from hydrogen and aliphatic groups having 1 to 18 carbon atoms and n is the valence of M, wherein the ratio of organo borate ester: phosphorodithioate is 1:15 to 15:1; and

(v) phosphorodithioate esters of the formula (VI):

$$R^{19}$$
 O R^{21} O R^{22} O

wherein R¹⁹, R²⁰, R²¹, and R²² may be the same or different and are selected from alkyl groups having 1 to 8 carbon atoms; wherein the ratio of organo borte ester: phosphorodithioate ester is 1:15 to 15:1; and

(vi) a non-sulfur molybdenum additive prepared by reacting (a) about 1.0 mole of fatty oil having 12 or more carbon atoms, (b) about 1.0 to 2.5 moles diethanolamine and (c) a molybdenum source, wherein the ratio of organo borate ester: non sulfur molybdenum additive is 1:15 to 15:1.